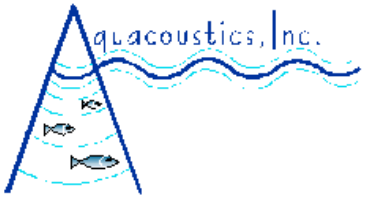
U.S. Fish and Wildlife Service
Office of Subsistence Management
Fisheries Resource Monitoring Program

Indexing the inseason abundance of salmon in the lower reaches of the Copper River Delta, 2006 Final Annual Report

Final Report No. FIS 04-506



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Indexing the inseason abundance of salmon in the lower reaches of the Copper River Delta, 2006 Final Annual Report

Annual Report No. 04-506

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April 2007

Annual Report Summary Page

Title: Indexing the inseason abundance of salmon in the lower reaches of the Copper River Delta, 2006 Final Annual Report

Study Number: 04-506

Investigators/Affiliations: Bruce Cain and Keith van den Broek/Native Village of Eyak; Anna-Maria Mueller and Don Degan/Aquacoustics, Inc.; Steve Moffitt/Alaska Department of Fish and Game, Commercial Fisheries Division; Michael Link and Jason Smith/LGL Alaska Research Associates, Inc.

Management Regions: Cook Inlet/Gulf of Alaska

Information types: Stock Status Trends, Fisheries Monitoring

Issues Addressed: Improve inseason escapement indices of salmon in the lower Copper River, downstream of the Miles Lake sonar site.

Study Cost: $193,059 (three-year total)

Study Duration: March 2004 – February 2007

Key Words: Copper River, inseason management, sockeye salmon, *Oncorhynchus nerka*, Chinook salmon, *Oncorhynchus tshawytscha*, subsistence fishery, sonar, acoustics, Native Village of Eyak.

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EXECUTIVE SUMMARY

The purpose of this three-year project (2004-2007) is to generate a daily inseason index of early run salmon abundance in the lower Copper River, and to estimate the travel time of salmon from the commercial fishing area (Copper River District) to the test fishery at Flag Point Channel and the Miles Lake sonar site. This will provide Alaska Department of Fish and Game (ADF&G) fisheries managers with more timely escapement information than is currently available from the Miles Lake sonar site alone. The project builds on the results of a study conducted in the previous three years (2001-2004), which compared the utility of acoustics and drift gillnets as test fishing tools, developed a cost-effective method for acoustic sampling, and provided insights into fish migratory behavior in the study area.

In 2006, acoustic sampling at Flag Point Channel started on 5 May, 8 days before the Miles Lake sonar site was fully operational and 10 days before the first commercial fishing period. Acoustic sampling continued until 29 May 2006. Apart from minor disruptions, sampling was essentially continuous. Visual echo trace counts were generated from the echogram during the first 15 minutes of each hour. As in previous years, salmon echo traces were easily distinguished from eulachon. Daily counts, calculated by summing and expanding 15-minute counts, totaled 2,120 salmon for the period sampled, with a peak of 424 fish on 29 May. Counts up to 0700 hours of the current day were reported to ADF&G daily by 0900 hours.

As in previous years other than 2003, acoustic counts of salmon for Flag Point Channel provided a presence/absence index of salmon abundance. The counts indicated an anomalously late run timing, with significant numbers not observed until after 23 May. This also tracked the general trends in salmon abundance observed at the Miles Lake sonar site. Similar to previous years, estimated travel time ranged from 1 – 3 days between the sampling site at Flag Point Channel and Miles Lake (approximately 30 km distance).

INTRODUCTION

This project addresses subsistence fisheries-monitoring issues for Copper River sockeye *Oncorhynchus nerka* and Chinook *O. tshawytscha* salmon, as outlined under Stock Status and Trends by the Federal Subsistence Regional Advisory Council in the Fall of 2002 (OSM 2002). It addresses the need for annual collection and reporting of salmon stock assessment for stocks that support important federal subsistence fisheries. The main goal of this project is to index the abundance of salmon in the lower Copper River, and to provide fishery managers with timelier inseason information than is currently available from the Miles Lake sonar site. The lower river index is not intended to replace or duplicate the existing Miles Lake sonar site. Instead, its purpose is to provide a more timely index of salmon abundance that fishery managers can use in conjunction with the more precise but delayed information from Miles Lake to better manage the commercial fishery, and ensure that an adequate number of early run fish make it upriver for subsistence harvests and spawning escapement requirements.

The three-year pilot study (2001–2003) also compared the relative strengths and weaknesses of acoustics and drift gillnetting to identify which technique would be the better choice for continued use on the lower Copper River (Degan et al. 2004). The authors concluded to discontinue drift gillnetting and use acoustics to index salmon abundance at Flag Point Channel. This conclusion was largely based on the substantially higher sampling power of acoustics and its ability to differentiate up- and downstream migration.

This project builds on the results and experience gained in the three-year pilot study. Project objectives were to:

1. Generate a daily inseason index of early run salmon abundance in the lower Copper River to provide ADF&G managers with more timely escapement information than is available from the Miles Lake sonar site; and

2. Estimate the travel time of salmon from the commercial fishing area (Copper River District) to both the test fishery at Flag Point Channel and the Miles Lake sonar site.

STUDY AREA

The Copper River flows through the Chugach Mountains of Alaska and drains into the northern limits of the Gulf of Alaska, east of Prince William Sound (Figure 1). The lower river sample site is located in the Flag Point Channel, 400 m downstream of Bridge 331 of the Copper River Highway (Figure 2). This site is approximately 30 river kilometers downstream of the Miles Lake Sonar Station, and 20 river kilometers upstream of the Cordova Commercial Fishing District. In April 2006, while low water exposed much of the sampling area, the site was again inspected. No major changes were found. The gradient of the site was still smooth and uniform but compared to previous years, there was less debris embedded immediately upstream. Quantity of water flow through the channel also appeared slightly reduced from previous years. The site appeared again suitable for acoustic sampling and no new bathymetry survey was conducted.

METHODS

River stage height and weather information were recorded on most sampling days. Stage height was measured at a U.S. Geological Survey (USGS) gauge mounted on Bridge 331 and provided a relative measure of river elevation (the elevation of the bridge above sea level was not known). Stage height data were also obtained from a USGS gauge mounted on Million Dollar Bridge located at the outlet of Miles Lake. Weather information collected each day included cloud cover, precipitation, wind velocity (km/h), and wind direction.

The acoustic system and methods used in 2006 was the same system used in 2004 and 2005 (Mueller and Degan, 2005, Degan et al, 2005). The transducer was deployed nearshore on the river bottom and aimed offshore, perpendicular to the river current, with the wide axis of the beam horizontal and the narrow axis vertical. The design of the transducer mount allowed adjustments in the vertical position and tilt angle of the acoustic beam. An analog tiltmeter (+/- 10° angular range, 0.5° resolution) was attached to the mount, such that its tilt was aligned with the transducer. This tiltmeter, which provided a direct read of the transducer tilt angle, allowed easy and controlled adjustment of the transducer on site without requiring access to computer data. A float switch was installed to automatically turn off the echosounder when the transducer became exposed to air, thereby preventing damage to its ceramic elements.

The operational setup of the camp was different again in 2006. Despite the overwhelming success of changes in consolidating the entire setup on the streamside in 2005, because of changes to available communications and power supply, it was decided in 2006 to once again split the setup to a trailer site and a sampling site, connected by a wireless bridge for data transfer. The sampling location was the same as was used in the previous three years (Mueller and Degan, 2005). However, the trailer was located at a new site at the base of a recently completed Cordova Telephone Cooperative (CTC) microwave communications tower located at the northwest side of Bridge 331. A weatherproof aluminum box at the sampling site housed the echosounder, power supply, wireless router and a laptop computer (Gateway SOLO, Pentium II, Linux). A directional 802.11g antenna transmitted data to a duplicate antenna mounted at the USGS gauging station on Bridge 331, which was connected by a CAT5 cable to equipment housed in the trailer. Technicians resided in a 12 foot Casita travel trailer, which also housed a landline telephone, DSL modem, router, and laptop computer (Dell D600, 512 MB RAM, 1.2 GHz Processor, 40 GB Storage, Windows XP) with 250 GB external hard drive. Power was supplied to the trailer by CTC industrial generators. The laptop computer in the box was programmed to transmit all data files automatically to the trailer computer, where they were stored on the external hard drive and a technician could subsample relevant files, conduct data analysis, and manually upload relevant echogram files to a remote ftp server via a DSL internet connection. The power supply at the sampling site consisted of a 12-V battery bank with a capacity of 700 amp hours, charged through an 3000-W inverter/charger by two 75-W solar panels and a 5-kW generator. The DSL internet connection was used mainly for data transfer to NVE in Cordova and Aquacoustics personnel who checked the counts and the quality of the acoustic data and provided technical support to the on-site crew. Landline telephone and email were the primary means of communication. A VHF radio was available for emergencies and to relay telephone communications to the remote Baird Canyon Research Camp.

To sample migrating salmon, the transducer was aimed along the river bottom. The aim of the transducer was verified using a plastic sphere (10-cm diameter) with target strength similar to an adult salmon. The sphere was lowered in front of the transducer using a fishing rod, raised 15 cm off the river bottom and then moved in- and offshore as much as water depth and current allowed. The aim of the transducer was confirmed when the target echoes were clearly visible and strong enough to qualify as salmon at least every 0.5 m. Fish were sampled with a transmit power of 200 W, ping rate of 14 pings per second, and a pulse length of 0.256 milliseconds.

A weir made from rebar and construction fencing was installed approximately 1 m downstream of the transducer and extended into the river about 1 – 2 m past the transducer. The weir kept fish from passing close to the transducer where the acoustic beam is not coherently formed or too small to efficiently detect fish. The weir had to be close to the transducer to prevent fish from coming back inshore before having passed the transducer. In addition, several pieces of rebar were put in about 20 m upstream of the transducer to direct ice floes offshore and away from the transducer. Unlike the weir, the ice deflection bars had to be at least 15 m upstream of the transducer to prevent the acoustic noise created downstream of an obstacle from interfering with the sonar beam. The position of the ice deflection bars also took advantage of the natural pattern of the river current, which, at that location, hit and was deflected off the riverbank at a relatively steep angle. Technicians regularly removed debris from the weir and the transducer mount and wiped algae growth off the transducer face.

Counts were done for the first 15 minutes of each hour using the same methodology as in 2004 (Mueller and Degan, 2005). Daily counts were generated by summing and expanding the 15-minute counts to hourly counts by multiplying by 4. When data collection was interrupted, counts were expanded for missing hours by taking the interpolation between the last good hour before the data gap and the first good hour after the gap.

RESULTS

Stage height of the Copper River was recorded at the Flag Point Channel East and West Bridge beginning 7 May and at the Million Dollar Bridge starting 14 May (Table 1). Throughout the sampling period, stage height was betwee 7.0 and 10.6 m at the Flag Point Channel and between 39.0 and 41.4 m at the Million Dollar Bridge.

The acoustic system was operated at Flag Point Channel for a total of 432 h (85% of the time) from 1200 hours on 5 May to 2359 hours on 29 May 2006. Counts were interrupted for a total of 78 h during the season, due to interruptions in wireless data transmission, transducer misalignment from ice or debris, technician error, and dropping water level.

A transducer pitch of -3.5 to -4° was maintained throughout the sampling period, yielding a counting range of up to 17 m, at least 3 m less than 2005.

Visual review of target strength echograms showed very good separation of eulachon (*Thaleichthys pacificus*) and salmon. Displaying the echograms at very low thresholds (-65 dB

and lower) revealed eulachon tracks but these were easily discerned from the much stronger tracks left by salmon. Angle echograms indicated little to no downstream movement of salmon.

Daily counts totaled 2,120 salmon for the period sampled (5 - 29 May), with a peak of 424 fish on 29 May. It took the field technicians approximately 3-h to count a 24-h period. NVE and Aquacoustics staff checked a subsample of at least four 15-minute counts per day and provided feedback to the technicians within 24 hours. Validated counts were forwarded to fishery managers and interested user groups by 0900 hours each day.

Run timing was anomalously late in 2006, with counts lower than 100 fish daily prior to 23 May (Figure 4). Despite this, similar to most previous years, relative changes in acoustic counts at Flag Point Channel mirrored the trends in the counts generated by the Miles Lake sonar. The comparison of time series plots of acoustic counts with Miles Lake data lagged 1-day provided the best alignment of peaks and slopes of the Flag Point Channel and Miles Lake counts. (Figure 3). Further inspection of the time series using a 1-day lag suggested a distinct change in the ratio between the Flag Point Channel and Miles Lake counts. For the first three quarters of the season, when acoustic counts were low at both sites and most other major river channels remained jammed with river ice, the ratio of fish was close to 1:1. The ratio dropped from 1:1 prior to 23 May to 10:1 May 24-25, and dropped further each day to as low as 80:1 by 29 May.

A reliable 3-day moving average of the Flag Point Channel acoustics catch efficiency (Flag Point Channel index per 1,000 fish counted at Miles Lake) could not be derived in 2006, and subsequently could not be compared to data from previous years. This is because, due to the late run timing, essentially only seven days of the month provided high enough counts for comparison, and during these days counts were increasing more dramatically at the Miles Lake site than ever before seen, causing the ratio at Flag Point to decline exponentially on a daily basis from 23 May on.

In 2006, the commercial fishery was opened three times prior to significant observed fish passage at Flag Point, and then remained closed from 23 May through the duration of sampling. Because of the schedule of commercial fishery openings, combined with late run timing, response of daily acoustic indices at Flag Point could not be correlated with commercial fishery openings as in the previous five years. Therefore, migration time between the fishery and the Flag Point Channel could not be derived in 2006 (Figure 3).

DISCUSSION

No problems were encountered with the Simrad ER60 data acquisition software, Sonardata Echoview counting software, or the EK60 echosounder system throughout the sampling period. Once installed, the DSL internet system also performed very well. Prior to availability of DSL, dial-up internet provided a suitable alternative for data transfers. The main problem which led to downtime in data collection resulted from loss of communication between computers on the 802.11g wireless bridge. When compared to the relative ease of data transfer in 2005, the trade-off in complicating the system to allow for high speed DSL internet was not necessarily a good one.

As in most previous years, acoustic sampling conditions at Flag Point Channel were very good in 2006. The river channel was free of ice up to a week before other channels on the river. A slight change in the channel bathymetry resulted in a reduced counting range to a maximum of 17 m, at least 3 m less than previous years, but still allowing high quality data. Consistent display settings and the high quality of acoustic data made it easy to distinguish salmon from eulachon tracks. Having no threshold applied to data collection meant that data could also be viewed at lower display thresholds than in the past, which sometimes helped in the interpretation of the data. Review of angle color echograms indicated that very few salmon were moving downstream.

The total number of salmon counted, the good separation of salmon and eulachon, and fish behavior were comparable to the first two years of the pilot study, and the first two years of the current study. After the difficulties experienced in 2003, and from anecdotal information from commercial fishermen in the Copper River District, there was concern that the low-water conditions in Flag Point Channel were related to the Copper River shifting towards its eastern channels to an extent that would make Flag Point Channel unsuitable for sampling. Results from 2004 and again in 2005 indicated that Flag Point Channel is still suitable for acoustic sampling. It is difficult to derive the same conclusion in 2006 due to the anomalous late run timing and subsequent short duration of actual data collected. The highly dynamic delta remains, of course, unpredictable and the site will need to be reassessed every year before sampling.

Fishery managers recognize two broad but useful levels of precision for "indexing" in-river escapement from the commercial fishery in the Copper River District: presence/absence and a more quantitative measure such as: more than a few hundred fish, less than 20,000 fish, etc. Each year, in the earliest stages of the salmon run (mid-May), managers simply want to know whether or not there are fish present in the river upstream of the commercial fishery. This is sometimes enough information to influence management decisions. In 2006, as in every year since its inception, with the exception of 2003, the Lower River Sonar Project accomplished the goal of determining when fish first entered the river in significant numbers. Sufficient data were not collected to allow comparison with past years in the continued development of an acoustic index that is more precise than mere presence or absence.

The speed at which fish migrated from Flag Point Channel to Miles Lake (1-3 days for approximately 30 km) was similar to previous years. Because of the schedule of commercial fishery openings, combined with the late appearance of fish at both sonar sites, it was not possible to derive travel time from the commercial fishery in the Copper River District to Flag Point Channel. In previous years, the apparent speed of migration from the commercial fishing district to Flag Point Channel has been 1-2 days for approximately 20 km. Assuming a similar speed of migration in 2006, the Flag Point Channel index provided information on the number of fish entering the river that was 1 – 3 days more up-to-date than the Miles Lake sonar counts.

An advantage of the Lower River Test Fishery project arises from the early start-up date. In 2006, acoustic sampling at Flag Point Channel began on 5 May, 8 days before the Miles Lake sonar site was clear of ice and fully operational and 10 days before the first commercial fishing period. Additionally, the Flag Point channel was entirely free of river ice up to a week before

any other major channel below Miles Lake, providing assumedly the only clear passage for salmon entering the river early in the season. Early in the season, when high fish prices add to the pressure on managers to open the commercial fishery, up-to-date information on early run escapement is especially important to the continued success of the population and the inriver subsistence fisheries.

CONCLUSIONS

1. The quality of the acoustic data was very good. Salmon were easily distinguished from eulachon. Flag Point Channel remained suitable for sampling.

2. Flag Point Channel counts provided a clear presence/absence type index and mirrored the general trends in the Miles Lake counts. Trends in the catch efficiency over the study period were similar to those observed in 2002, 2004 and 2005.

3. The apparent fish migration speed was similar to previous years. A 1-day lag between Flag Point Channel and Miles Lake produced best match. Because of the schedule of commercial fishery openings, combined with the late appearance of fish at both sonar sites, it was not possible to derive travel time from the commercial fishery in the Copper River District to Flag Point Channel.

4. This project has been a challenging but highly successful endeavor for the Native Village of Eyak over the past 6 years. The up-to-date inseason data provided to commercial fishery managers have been invaluable, and this contribution has helped NVE to become an integral part of fisheries management in the region.

RECOMMENDATIONS

This project is no longer funded under the FRMP after 2006. The project has proven extremely useful to commercial fisheries managers in Cordova. We recommend that ADF&G Commercial Fisheries Division source funding to continue operation of this project in future years, either internally or in collaboration with the Native Village of Eyak. If funding is secured, recommendations would be:

1. Continue to use acoustics to provide a daily inseason index of abundance of early run, lower river Copper River salmon;
2. Investigate the continued quality of the sampling site at Flag Point Channel. 2006 was an anomalous late run, and it is difficult to conclude that the site continues to be a primary migration channel for salmon. Anecdotal information suggests run strength is shifting to more easterly channels as the river slowly changes course. A better, albeit more remote, sampling site may need to be located.

ACKNOWLEDGMENTS

Special thanks to Bryan Bibeau, NVE technician and Jon Syder, ADF&G technician who conducted the acoustic fieldwork and provided inseason counts. Keith van den Broek and Amy Lindsley (NVE) and Don Degan (Aquacoustics, Inc) counted for quality control and summarized the data for release, and provided logistical support that was instrumental to the success of this project. We also thank Cordova Telephone Cooperative for providing landline telephone, DSL internet, and reliable electrical power at the site.

This project was approved by the Federal Subsistence Board, managed by the U.S. Fish and Wildlife Service, Office of Subsistence Management and funded by the USDA Forest Service (USFS) under contract 53-0109-4-0038. The project was a cooperative effort between the USFS, NVE, Aquacoustics, LGL and ADF&G.

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FIGURES

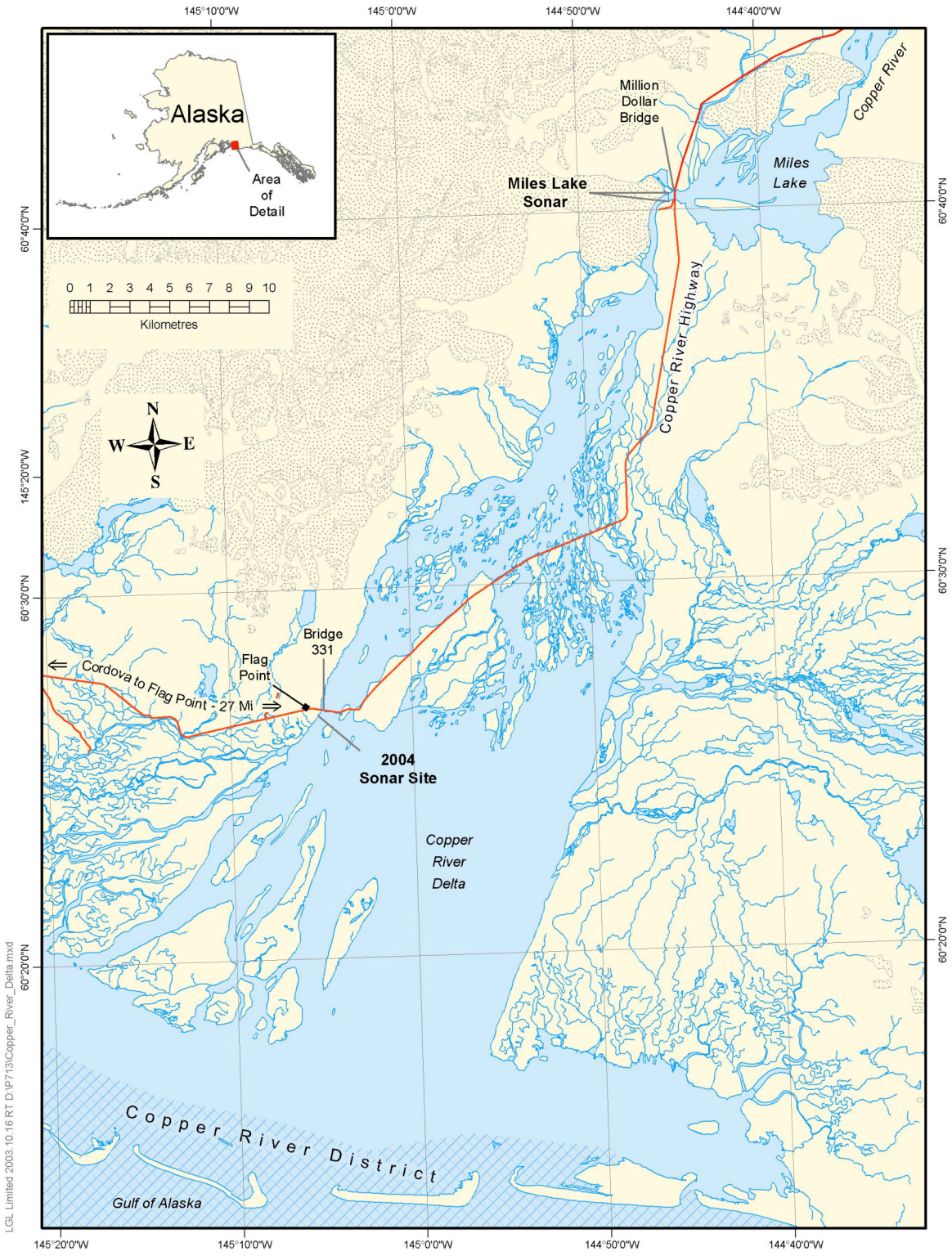

Figure 1. Map of the lower Copper River in Alaska showing the location of Flag Point Channel and the Miles Lake sonar site, 2002-2006.

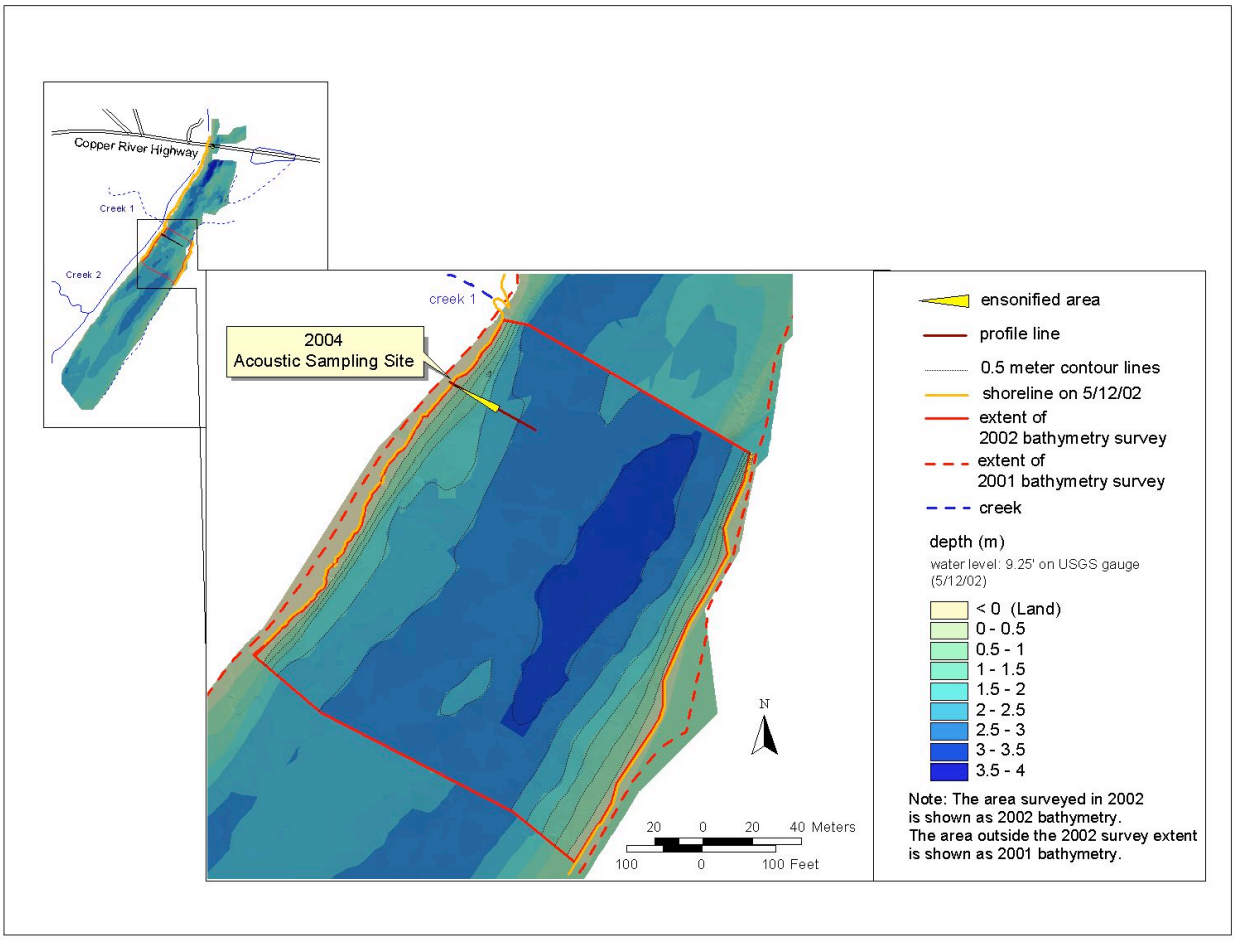

Figure 2. Bathymetry of the Flag Point Channel acoustic sampling site used 2002 through 2006. The site was located 400 m downstream of Bridge 331 on the Copper River Highway.

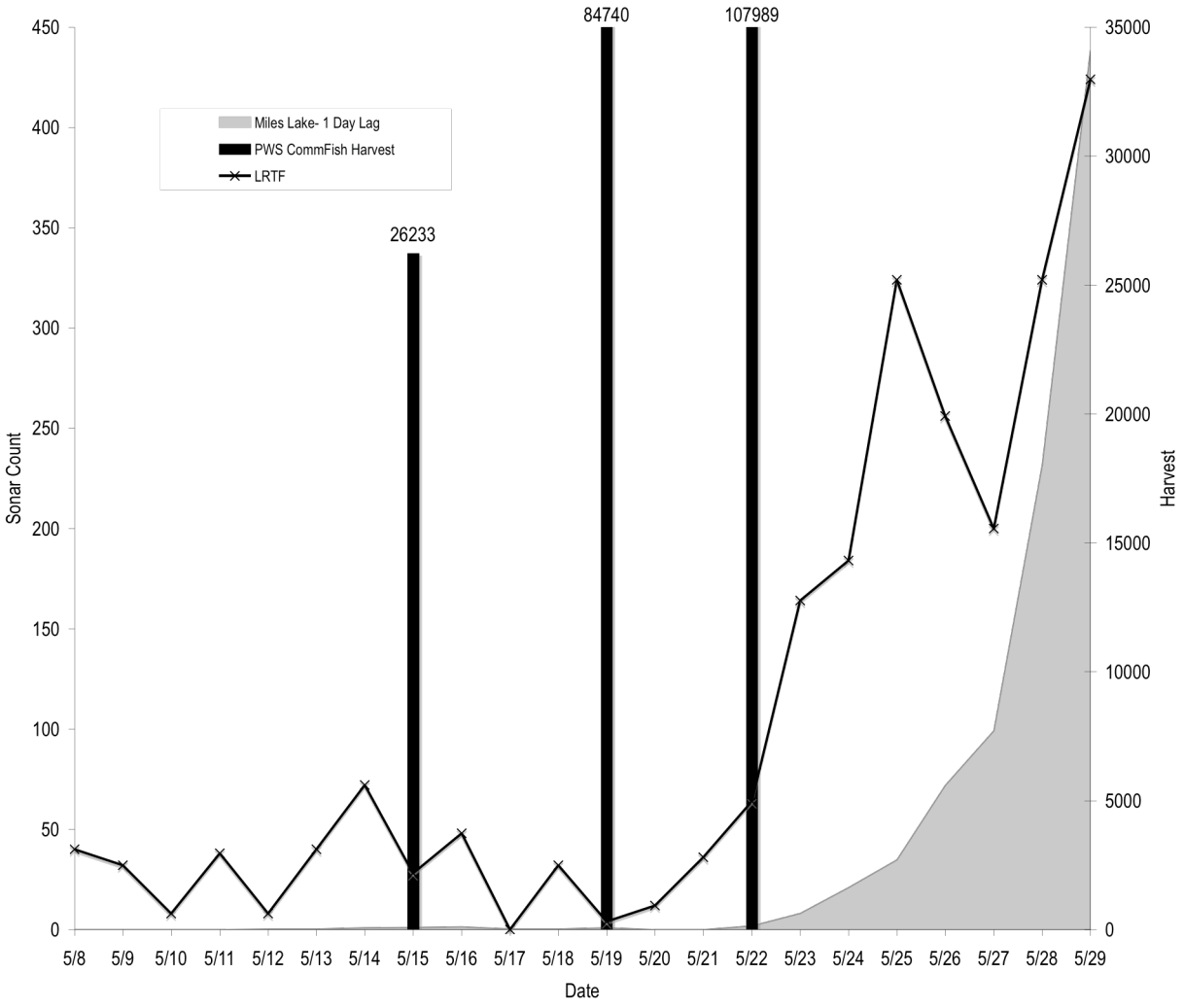

Figure 3. Daily acoustic indices for salmon at Flag Point Channel, sonar counts from Miles Lake and the starting dates of commercial fishing openings in the Copper River District, 2006.

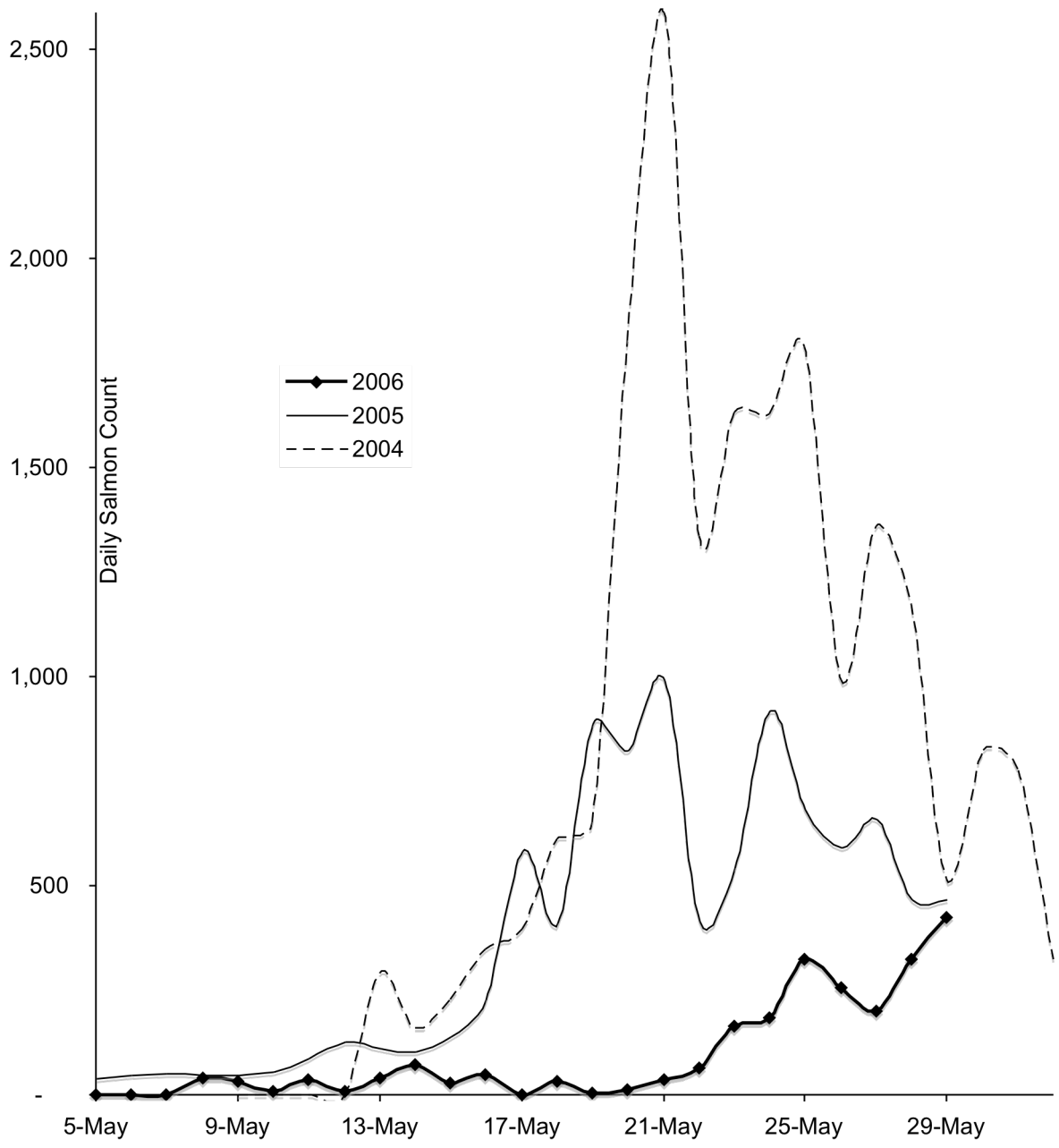

Figure 4. Daily Acoustic Counts at Flag Point Channel, 2004-2006.

TABLES

Table 1. Stage height (m) of the Copper River at Flag Point Channel and the Million Dollar Bridge, 2006. Stage height was measured using USGS gauges and is a relative measurement as the current bridge elevations above mean sea level are unknown.

	Flag Point Channel		Million Dollar Bridge
Date	West Bridge	East Bridge	
7-May	7.00		
8-May	9.00		
9-May	9.00		
10-May			
11-May	9.71	10.00	
12-May	9.47	9.74	
13-May	8.32	8.57	
14-May	8.11	8.39	39.28
15-May			39.04
16-May	7.67	7.91	39.42
17-May			39.63
18-May	8.00	8.24	39.79
19-May	8.35	8.67	39.89
20-May	8.55	8.80	40.02
21-May	8.25	8.57	39.77
22-May	8.38	8.69	39.83
23-May	8.13	8.46	39.91
24-May	8.33	8.65	40.14
25-May	8.50	8.84	40.38
26-May	9.00	9.27	40.65
27-May	9.26	9.52	40.93
28-May	10.38	10.57	41.30
29-May	10.40	10.63	41.39

Table 2. Daily salmon counts and escapement objectives at the Miles Lake sonar, 2006.

		Daily Escapement Counts				Inriver Escapement Objective			
						Minimum		Maximum	
Date	Water Level	North Bank	South Bank	Daily	Cumulative	Daily	Cumulative	Daily	Cumulative
12-May		0		0	0				
13-May		18		18	18				
14-May	39.28	24		24	42				
15-May	39.04	72		72	114				
16-May	39.42	78		78	192	365	365	480	480
17-May	39.63	102		102	294	579	944	761	1,240
18-May	39.79	18		18	312	1,737	2,681	2,283	3,523
19-May	39.89	18		18	330	3,045	5,727	4,001	7,525
20-May	40.02	72		72	402	4,433	10,160	5,824	13,349
21-May	39.77	0		0	402	5,008	15,168	6,580	19,929
22-May	39.83	0		0	402	7,700	22,867	10,117	30,045
23-May	39.91	12	126	138	540	8,783	31,650	11,540	41,585
24-May	40.14	6	621	627	1,167	9,696	41,347	12,740	54,325
25-May	40.38	16	1,623	1,639	2,806	11,079	52,425	14,556	68,882
26-May	40.65	16	2,690	2,706	5,512	13,656	66,082	17,943	86,825
27-May	40.93	64	5,526	5,590	11,102	12,927	79,009	16,985	103,810
28-May	41.30	408	7,302	7,710	18,812	13,760	92,769	18,079	121,889
29-May	41.39	1,256	16,734	17,990	36,802	13,820	106,589	18,158	140,047
30-May	41.23	4,272	29,850	34,122	70,924	15,065	121,654	19,794	159,841
31-May	41.20	11,480	40,236	51,716	122,640	13,240	134,894	17,396	177,237
1-Jun	41.36	7,344	43,794	51,138	173,778	15,183	150,077	19,949	197,186
2-Jun	41.26	9,832	37,902	47,734	221,512	13,733	163,809	18,043	215,229
3-Jun	41.24	7,712	44,508	52,220	273,732	13,603	177,412	17,873	233,102
4-Jun	41.45	6,392	28,386	34,778	308,510	12,564	189,976	16,508	249,610
5-Jun	41.67	3,472	13,122	16,594	325,104	13,639	203,615	17,920	267,530
6-Jun	41.64	3,336	16,158	19,494	344,598	11,592	215,207	15,231	282,761
7-Jun	41.40	1,584	15,330	16,914	361,512	12,707	227,915	16,696	299,457
8-Jun	41.27	1,520	12,690	14,210	375,722	13,315	241,229	17,494	316,951
9-Jun	41.31	1,760	10,716	12,476	388,198	11,471	252,700	15,071	332,022
10-Jun	41.36	2,056	14,304	16,360	404,558	10,285	262,985	13,514	345,536
11-Jun	41.62	1,736	9,750	11,486	416,044	9,416	272,401	12,372	357,908
12-Jun	42.00	1040	7,560	8,600	424,644	8,340	280,742	10,958	368,866
13-Jun	42.25	864	10,452	11,316	435,960	7,292	288,034	9,581	378,448
14-Jun	42.40	888	15,462	16,350	452,310	7,130	295,164	9,369	387,816
15-Jun	42.59	1,312	18,420	19,732	472,042	7,560	302,724	9,933	397,749
16-Jun	42.88	920	9,960	10,880	482,922	7,447	310,171	9,785	407,534
17-Jun	43.14	992	9,096	10,088	493,010	7,395	317,567	9,717	417,251
18-Jun	43.20	1,544	10,908	12,452	505,462	7,206	324,773	9,468	426,719
19-Jun	43.20	1,504	16,380	17,884	523,346	7,479	332,252	9,827	436,546
20-Jun	43.05	1,120	13,608	14,728	538,074	7,142	339,394	9,384	445,930
21-Jun	42.80	1,016	14,370	15,386	553,460	6,968	346,362	9,155	455,085
22-Jun	42.51	736	14,730	15,466	568,926	6,712	353,075	8,819	463,905
23-Jun	42.36	672	9,756	10,428	579,354	6,311	359,385	8,292	472,196

Table 2 (cont). Daily salmon counts and escapement objectives at the Miles Lake sonar, 2006.

		Daily Escapement Counts				Inriver Escapement Objective			
						Minimum		Maximum	
Date	Water Level	North Bank	South Bank	Daily	Cumulative	Daily	Cumulative	Daily	Cumulative
24-Jun	42.28	624	8,658	9,282	588,636	6,314	365,700	8,296	480,493
25-Jun	42.10	1,360	12,846	14,206	602,842	6,508	372,208	8,551	489,043
26-Jun	42.16	296	10,662	10,958	613,800	7,232	379,439	9,502	498,545
27-Jun	42.15	656	7,614	8,270	622,070	7,380	386,819	9,697	508,242
28-Jun	42.02	1,000	8,622	9,622	631,692	7,528	394,347	9,891	518,133
29-Jun	42.06	840	8,916	9,756	641,448	7,625	401,972	10,018	528,151
30-Jun	42.23	576	7,494	8,070	649,518	7,049	409,022	9,262	537,413
1-Jul	42.32	664	8,904	9,568	659,086	7,124	416,146	9,361	546,774
02-Jul	42.40	1,184	11,040	12,224	671,310	6,819	422,965	8,959	555,733
03-Jul	42.52	872	13,152	14,024	685,334	6,824	429,789	8,966	564,699
04-Jul	42.69	864	9,312	10,176	695,510	7,168	436,957	9,418	574,117
05-Jul	42.89	2,024	6,972	8,996	704,506	7,673	444,630	10,082	584,199
06-Jul	43.13	1,080	8,760	9,840	714,346	7,888	452,519	10,365	594,564
07-Jul	43.50	552	6,348	6,900	721,246	7,564	460,083	9,938	604,502
08-Jul	43.51	1,048	4,572	5,620	726,866	8,061	468,143	10,591	615,093
09-Jul	43.48	1,232	6,336	7,568	734,434	8,342	476,485	10,961	626,054
10-Jul	43.29	896	9,702	10,598	745,032	8,048	484,533	10,574	636,628
11-Jul	43.08	2,632	8,778	11,410	756,442	7,930	492,463	10,419	647,047
12-Jul	43.20	1,728	9,096	10,824	767,266	9,794	502,257	12,868	659,915
13-Jul	43.26	1,472	10,458	11,930	779,196	9,241	511,498	12,142	672,057
14-Jul	43.44	1,696	8,382	10,078	789,274	8,968	520,466	11,783	683,840
15-Jul	43.56	1,424	9,084	10,508	799,782	9,614	530,080	12,632	696,472
16-Jul	43.53	752	7,158	7,910	807,692	9,017	539,097	11,847	708,319
17-Jul	43.27	792	9,192	9,984	817,676	7,382	546,479	9,700	718,019
18-Jul	42.89	1,256	11,670	12,926	830,602	7,797	554,276	10,244	728,263
19-Jul	42.70	1,336	11,148	12,484	843,086	7,154	561,430	9,400	737,663
20-Jul	42.64	3,752	9,728	13,480	856,566	6,497	567,927	8,536	746,199
21-Jul	42.64	2,080	8,010	10,090	866,656	6,286	574,213	8,260	754,459
22-Jul	42.62	1,248	6,678	7,926	874,582	6,014	580,228	7,902	762,361
23-Jul	42.59	1,904	6,660	8,564	883,146	5,114	585,342	6,720	769,081
24-Jul	42.52	1,880	10,050	11,930	895,076	5,282	590,624	6,939	776,020
25-Jul	42.66	2,040	7,962	10,002	905,078	4,777	595,401	6,277	782,297
26-Jul	42.84	1,210	6,636	7,846	912,924	4,451	599,852	5,848	788,146
27-Jul	42.85	1,000	5,934	6,934	919,858	4,123	603,975	5,417	793,563
28-Jul	42.73	2,632	7,326	9,958	929,816	3,844	607,819	5,051	798,614
29-Jul	42.70	3,200	9,294	12,494	942,310	3,099	610,918	4,071	802,685
30-Jul	42.78	2,432	7,530	9,962	952,272	2,750	613,668	3,613	806,298
31-Jul	43.01	1,440	5,994	7,434	959,706	2,559	616,227	3,362	809,660

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